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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/749,917	12/29/2000	Christopher C. Chang	015290-458	6832

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BURNS DOANE SWECKER & MATHIS L L P
POST OFFICE BOX 1404
ALEXANDRIA, VA 22313-1404

EXAMINER	
UHLIR, NIKOLAS J	

ART UNIT	PAPER NUMBER
1773	7

DATE MAILED: 05/22/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/749,917	CHANG ET AL.	
	Examiner	Art Unit	
	Nikolas J. Uhlir	1773	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____ .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *14-34* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *23 and 24* is/are allowed.

6)☒ Claim(s) *14-22 and 25-34* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Claim Rejections - 35 USC § 102

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

1. Claims 14, 15, 18, 19, 26, and 33 are rejected under 35 U.S.C. 102(b) as being anticipated by Nguyen et al (US5302420)

2. The limitations "an as sprayed plasma sprayed coating," "an as sprayed roughness," and "plasma spraying a coating", present in claims 14 and 34 are process limitations and do not appear to be further limiting in so far as the structure of the product is concerned. "[E]ven though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process." *In re Thorpe*, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985). See MPEP § 2113.

3. Nguyen et al. teaches a process for fabricating fluorocarbon layers on a substrate via plasma enhanced chemical vapor deposition (column 1, lines 8-20). This process comprises the steps of pre-coating the chamber walls and working electrode(s) of the apparatus with a fluorocarbon layer, after which a substrate is placed in the chamber and coated with a layer of fluorocarbon. The apparatus used in this process is a vacuum chamber made of stainless steel (column 2, lines 45-50). The fluorocarbon layer covering the walls and the electrode(s) of the apparatus is typically between 1-

5μm (column 3, lines 14-20). The fluorocarbon is plasma deposited from a gaseous polymerizable fluorocarbon, such as C_2F_4, C_4F_8, and C_3F_8, at radio frequency (column 3, lines 40-65). Regarding the requirement of "a surface roughness that promotes the adhesion of polymer deposits", the examiner takes the position that this limitation is necessarily met because any deposited coating will possess some level of surface roughness. Furthermore, it appears from the specification that the roughness required by the applicant is achieved simply by plasma depositing a material onto a surface. The applicant does not require a particular numerical range of roughness or adhesion in any of claims 14, 15, 18, 19, 26. Thus, because the fluoropolymer taught by Nguyen et al. is a plasma deposited coating, it is deemed to necessarily meet this limitation.

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 14-22, 25-32, and 34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shih et al. (US6120640) in view of Wicker et al. (US5993594) , further in view of Richardson et al. (US5916454).

The limitations “an as sprayed plasma sprayed coating,” "an as sprayed roughness," and "plasma spraying a coating", present in claims 14 and 34 are process limitations and do not appear to be further limiting in so far as the structure of the product is concerned. “[E]ven though product-by-process claims are limited by and

defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process." *In re Thorpe*, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985). See MPEP § 2113.

Shih et al. teaches a plasma etch reactor having interior components with surfaces facing the plasma wherein those components are comprised of bulk boron carbide or a coating of thermally sprayed boron carbide over a base material (Column 5, lines 16-21). These components include chamber walls, focus rings, and a gas distribution plate (columns 12 and 13, claims 18-21, and 24-25). Preferably, a component base, such as aluminum, is coated with a layer of thermally sprayed B_4C (column 5, lines 33-38). The aluminum part used as the substrate quickly forms a layer of oxide (Al_2O_3), which provides a good base for the thermally sprayed coating (column 8, lines 24-27). Al_2O_3 is an extremely well known ceramic material. Thus, the limitations of claim 32 are met. The thickness of the coating is typically between 5-10 mils (column 8, line 22). Although Shih et al. does not teach coating a component with the same material that makes up the component (for example a B_4C base coated with a layer of B_4C), the examiner takes the position that there is no functional difference between a plasma reactor part comprised of a single solid layer of material and a plasma reactor part that is coated with a layer, wherein the layer is made of the same material as the base onto which it is coated. Additionally Shih et al. teaches that components made of

either bulk silicon nitride or a base coated with thermally sprayed silicon nitride could be used as an alternative to boron carbide. Silicon nitride shares many of the erosion resistant qualities of boron carbide (column 10, lines 50-60). This coating is formed to provide increased durability to the plasma-exposed surfaces of interior components in plasma reactors (column 5, lines 14-15). Further Shih et al. teaches a method for processing a substrate in a plasma reactor containing the previously described parts. In this method, a plasma reactor containing a wall coated with a layer of plasma sprayed B_4C was used to etch aluminum. The etch recipe (process gas) included BCl_3, Cl_2, and Ar, and the inductively coupled plasma source power was 1500w, and the pedestal was biased with 145-200w of RF power column 11, lines 16-38). The B_4C component of this reactor could also be a wafer clamp, a plasma focus ring, a nozzle for processing gas, and a showerhead for processing gas (the gas distribution plate) (Column 13, claim 25). Further, Shih et al. teaches that there are three major types of plasma etching, each utilizing a similar reactor design, but each with their own preferred etching chemistry (column 1, lines 25-28). Metal etching, such as etching of aluminum, typically uses a chlorine based process gas as the etchant (column 1, lines 38-44). Etching of silicon however, typically uses hydrofluorocarbons such as C_2HF_5 and C_2F_6 as the processing gas, as taught by Wicker et al. (Wicker et al. Column 3, lines 33-42 and column 4, lines 29-36). Thus, the type of process gas used is a results effective variable. It would be obvious to select the type of process gas used to match the substrate to be etched.

Shih et al. does not teach a plasma reactor component with coating that has surface roughness characteristics that promote adhesion of polymer deposits. Further,

Shih et al. does not teach a coated plasma reactor component that has an arithmetic mean surface roughness value from 150-190 micro inches.

Richardson et al. teaches a method for manufacturing a plasma reactor chamber part, wherein the part is roughened to promote the adhesion of byproduct particles to the surface of the part (column 2, lines 25-33). This technique can be applied to any interior component of a plasma reactor chamber that is suitable for roughening (column 4, lines 29-34). Byproduct deposits typically of concern include silicon, silicon oxide and other carbon-based polymers (column 5, lines 5-11). Richardson et al. discloses that plasma reactor components are typically manufactured to maximize their smoothness, because this allows for a tight seal with other parts, easy cleaning, and low moisture absorption. However, this leads to increased particle contamination (column 5, lines19-35). The amount of particle contamination is reduced by roughening the surface of a chamber component, thereby increasing the adherence of byproduct particles to the component surface (column 5, lines 43-48). Thus, the surface roughness of a plasma reactor interior component is a results effective variable. One would roughen the surface to improve byproduct adhesion, and one would smooth the surface to promote easy cleaning and low moisture absorption. Therefore, it would have been obvious to one with ordinary skill in the art at the time the invention was made to optimize the roughness of the interior components to the range specified in order to achieve the desired adhesion of byproduct particles. The minimum roughness specified by Richardson et al. is typically greater than 2 micro inches (column 2, lines 60-53).

Further, it would have been obvious to one with ordinary skill in the art at the time the invention was made to impart the rough surface taught by Richardson et al. to the boron carbide coated reactor chamber components disclosed by Shih et al.

One would have been motivated to make this modification due to the increase in byproduct particle adhesion to the interior components one would expect to gain as a result.

Allowable Subject Matter

3. Claims 23 and 24 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Response to Arguments

4. Applicant's arguments filed 4/19/02 have been fully considered but they are not persuasive. In regards to the rejection of claims 14-31, the applicant made the following arguments.

- Claim 14 as amended now recites a component of a plasma reactor, the component comprising an as-sprayed plasma sprayed coating on a plasma exposed surface of the component, wherein the coating has an as sprayed surface roughness that promotes the adhesion of polymer deposits. Applicants submit that claim 14 is not a product by process limitation, but rather a "pure product" claim, because the recited "as-sprayed plasma sprayed coating" describes the product more by its structure than by the process used to obtain it.

This argument is not persuasive. The examiner maintains that the limitation “as sprayed surface roughness” is a process limitation in a product claim, and is does not appear to be further limiting in so far as the structure of the finished product is concerned. “[E]ven though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a

product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process." *In re Thorpe*, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985). See MPEP § 2113. The applicant has failed to show that there is a functional or structural difference between a coating that has been roughened after deposition and a coating that possesses a desired level of roughness when it first deposited. Thus, the rejection of claim 14 as written by the prior office action is maintained.

- Shih teaches away from the claimed invention because Shih seeks to provide a smooth surface. Although, Shih does disclose that surfaces on which the Boron Carbide coatings are formed by thermal spraying are preferably roughened to enhance sticking of the coating, Shih does not suggest roughening the coatings themselves. To the contrary, Shih discloses that boron carbide spray coatings applied over a roughened anodized surface have a relatively smooth surface relative to that of the roughened surface. Shih would have led one with ordinary skill in the art directly away from the component recited in claim 14.

This argument is not persuasive. The examiner acknowledges that Shih et al. teaches polishing the deposited B_4C coatings to provide "a much smoother surface." A "much smoother surface" is not a "perfectly" smooth surface, and allows for the presence of some level of surface roughness. Thus, Shih does not teach away from a coating having some degree of surface roughness.

- Richardson fails to cure the deficiencies of Shih with respect to the component in claim 14. Richardson does not suggest forming coatings by plasma spraying. Richardson does not suggest forming an as sprayed plasma sprayed coating that has an as sprayed surface roughness that promotes the adhesion of polymer deposits. Further, because Richardson discloses surface roughening treatments, whereas Shih discloses smoothing treatments, the combination of Shih and Richardson cannot possibly suggest an as sprayed plasma sprayed coating that has a surface roughness as recited in claim 14.

5. This argument is not persuasive. As discussed above, the limitations of an "as sprayed plasma sprayed coating," and an "as sprayed surface roughness" are product

by process claims. The examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988)and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, Shih teaches smoothing a deposited coating to provide "a much smoother surface." This statement allows for some level of surface roughness to be present for the coating. Richardson in the broadest sense teaches the benefits of having a plasma chamber part that has a surface with a specific surface roughness, the primary benefit being the increased adhesion of polymer deposits to the coating surface, thereby increasing the mean time between cleans for a plasma processing chamber. Thus, because Shih allows for the coating to have some level of surface roughness, and Richardson teaches that having a specific level of surface roughness on a plasma chamber part has the aforementioned benefits, there is clear motivation to combine the references. Therefore, the rejection of claim 14 as written is maintained.

- Shih teaches away from the combination of features recited in claim 21, which recites that the component and the coating material comprise the same ceramic material. Shih does not disclose forming boron carbide coatings on boron carbide substrates i.e. on the same material.

This argument is not persuasive. Shih clearly teaches that the plasma chamber parts can be formed of bulk boron carbide, or a layer of boron carbide deposited on the surface of a base material such as aluminum, see Column 5, lines 16-21 and 33-38. The examiner asserts in this and the prior office action that there is no functional

difference between a plasma reactor part comprised of a single solid layer of material (wherein the surface of the solid part is roughened) and a plasma reactor part that is coated with a layer of roughened material, wherein the coated layer of roughened material is made of the same material as the base onto which it is coated. The applicant in his arguments has neglected to show any difference between a plasma part that is made of a bulk material, and a plasma part that is coated with a layer, wherein the layer is made of the same material as the part onto which it is coated. Thus, the rejection is maintained as written.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Nikolas J. Uhlir whose telephone number is 703-305-0179. The examiner can normally be reached on Mon-Fri 7:30 am - 5 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Paul Thibodeau can be reached on 703-308-2367. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9310 for regular communications and 703-872-9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-305-0389.

nju
May 20, 2002

Paul Thibodeau
Supervisory Patent Examiner
Technology Center 1700